



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/599,896	10/12/2006	Satoshi Yonezawa	TOH-16912	6172
40854 7590 06/18/2009 RANKIN, HILL, & CLARK LLP 38210 Glenn Avenue WILLOUGHBY, OH 44094-7808				
EXAMINER GARDNER, SHANNON M				
ART UNIT		PAPER NUMBER		
1795				
MAIL DATE		DELIVERY MODE		
06/18/2009		PAPER		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/599,896

Applicant(s)

YONEZAWA ET AL.

Examiner

Shannon Gardner

Art Unit

1795

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 March 2009 (Applicant's Amendments).
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 and 3-5 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1 and 3-5 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

Applicant's amendment of 3/28/2009 does not render the application allowable.

Remarks

Applicant has amended claim 1 and cancelled claims 2 and 6-7. Currently claims 1 and 3-5 are pending in the application and are considered on their merits below.

Status of Objections and Rejections

All rejections from the previous office action are withdrawn in view of Applicant's amendments. New grounds of rejection necessitated by the amendments are set forth below.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakazawa et al. (US 6274805, cited in IDS) in view of Basol et al. (JP 11-340482, cited in IDS), Takeshi (JP 08-125206, cited in IDS) and Taiyo (JP 61-15763, cited in IDS).

As to claim 1, Nakazawa is directed to a chalcopyrite type solar cell (abstract and Figure 3) comprising a stack including:

- a first electrode composed of a metal (2) (column 7, lines 30-42 and column 9, line 39);
- a light adsorption layer (3) formed on or above the first electrode, which is composed of a chalcopyrite type compound serving as a P-type semiconductor (column 7, lines 30-45), and
- a second electrode (5) formed on or above the light adsorption layer which serves as an N-type semiconductor (column 7, lines 30-45), wherein:
 - an insulative substrate (6) retains the stack (see Figure 3).

Though Nakazawa teaches the use of a flexible substrate (column 7, lines 30-45), the reference is silent as to mica being contained in the insulative substrate that retains the stack and as to a smoothing layer having irregularities on an upper end surface thereof between the insulative substrate and the stack, the irregularities of the smoothing layer being smaller than irregularities on an upper end surface of the insulative layer and as to two binder layers composed of a nitrogen compound being interposed between the insulative substrate and the stack such that the binder layers sandwich the smoothing layer.

However, it is known in the art to utilize a mica substrate in a semiconductor device to allow for flexibility, as taught by Basol (paragraph [0017]). It is also known in the thin-film art to create a smooth coating layer of glass paste (i.e. SiO_2) over a substrate to make the substrate more suitable for a thin-film device, as taught by Taiyo (pp 4, lines 25-31 and pp 5, lines 11-15). Further, it is known to utilize a TiN binder layer between two layers to prevent peeling of an alloy film regardless of heat treatment thereby lowering manufacturing cost as taught by Takeshi (abstract).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize a mica substrate in the solar cell of Nakazawa to ensure flexibility of the device, as taught by Basol. It also would have been obvious to create a smoothing layer on the mica substrate in order to make the substrate suitable for a thin-film device, as taught by Taiyo. (It is the Examiner's position that as a molded mica substrate usually has a roughness of around $10\text{ }\mu\text{m}$ and the smooth coating of glass paste serves to minimize this roughness (Taiyo; pp 4, lines 25-31) the irregularities of

the smoothing layer will be smaller than the irregularities of the upper end surface of the insulative substrate.) Further, it would have been obvious to one of ordinary skill in the art at the time of the invention to include a TiN binder layers to sandwich the smoothing layer of modified Nakazawa to prevent peeling of the alloy film regardless of heat treatment thus lowering manufacture cost, as taught by Takeshi. **Examiner note:** the TiN layers taught by modified Nakazawa will act as a binder layer and a diffusion-prevention layer, respectively. Therefore, the TiN layer will inherently prevent diffusion of impurities from the insulative substrate.

The references are silent as to the binder layer having a thickness of 0.5 to 1 μm .

However, the Federal Circuit held that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device (see MPEP § 2144.04(IV)). Further, as the TiN film serves to prevent peeling between the two adjacent layers during heat treatment it stands to reason that a thin film of this material will be preferred.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to form the binder layer of modified Nakazawa to have a thickness of 0.5 to 1 μm .

5. Claims 3-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakazawa et al. (US 6274805, cited in IDS) in view of Basol et al. (JP 11-340482, cited

in IDS), Takeshi (JP 08-125206, cited in IDS) and Taiyo (JP 61-15763, cited in IDS) as applied to claim 1 above, and further in view of Sakai et al. (US 6750283).

Regarding claim 3, Applicant is directed above for a full discussion of Nakazawa in view of Basol and Takeshi as applied to claim 1. Though modified Nakazawa teaches an insulative mica substrate (Basol; paragraph [0017]), the references are silent as to the substrate comprising a mica aggregate of mica and a resin.

However, it is known in the composite art that mica aggregates are useful materials due to their high hardness and their ability to easily be bent or thinned for flexibility as taught by Sakai (column 1, lines 22-27 also see claim 15).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize a mica aggregate of mica and a resin in the modified solar cell of Nakazawa for ensured substrate hardness and flexibility as taught by Sakai.

Regarding claim 4, modified Nakazawa teaches the smoothing layer containing SiO₂ (glass paste) (Taiyo; pp 4, lines 25-31 and pp 5, lines 11-15).

6. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakazawa et al. (US 6274805, cited in IDS) in view of Basol et al. (JP 11-340482, cited in IDS), Takeshi (JP 08-125206, cited in IDS) and Taiyo (JP 61-15763, cited in IDS) as applied to claim 1 above, and further in view of Satoshi (JP 2001-257374, cited in IDS).

Regarding claim 5, Applicant is directed above for a full discussion of modified Nakazawa as applied to claim 1. Modified Nakazawa is silent as to a buffer layer and a semi-insulative layer being interposed between the light absorption layer and the second electrode.

However, it is known in the solar cell art to introduce a buffer layer (CdS, 4) and a semi-insulative layer (high resistance layer, 5) between a light absorption layer (CIS, 3) and a second electrode (8) as taught by Satoshi (abstract, description of drawings, Figures 1 and 2) to ensure photoelectric efficiency of the device.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to include a buffer layer and a semi-insulative layer between the light absorption layer and second electrode as taught by Satoshi in the modified device of Nakazawa in order to ensure photoelectric efficiency of the device.

Response to Arguments

7. Applicant's arguments filed 3/28/2009 have been fully considered but they are not persuasive:

Applicant argues that "Takeshi does not teach a binder layer between a smoothing layer and a mica-containing substrate and does not teach a binder layer between a smoothing layer and a first electrode of a chalcopyrite type solar cell..." (pp 5 of Arguments).

The Examiner respectfully disagrees. Taiyo teaches the smooth coating layer of glass paste (i.e. SiO_2) over a substrate to make the substrate more suitable for a thin-film device (pp 4, lines 25-31 and pp 5, lines 11-15). Further, it is known to utilize a TiN binder layer between two layers to prevent peeling of an alloy film regardless of heat treatment thereby lowering manufacturing cost as taught by Takeshi (abstract). The Examiner notes that the basis of rejection for claim 1 is over Nakazawa et al. in view of Basol et al., Takeshi and Taiyo. It would have been obvious to one of ordinary skill in

the art at the time of the invention to provide a TiN layer on either side of the smoothing layer to ensure proper adhesion and prevent peeling during heat treatment.

Applicant argues that "Nakazawa already discloses the use of TiN layers in a chalcopyrite type solar cell...Nakazawa teaches that this bonding layer should have a thickness of 0.01 to 0.1 microns" (pp 6 of Arguments).

The Examiner notes that the teachings of Nakazawa are not relied upon for the placement or thickness of the TiN layers. Takeshi is relied upon to teach the use of TiN layers as binder layers.

Applicant argues that "The Examiner concedes that the prior art does not teach layers having the thickness limitation now set forth in claim 1, but argues that it would have been obvious to use a TiN film having such thickness to prevent peeling..." (pp 6 of Arguments).

The Examiner notes that Applicant has provided no criticality regarding the thickness of the TiN films. Further, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device (see MPEP § 2144.04(IV)). Designing the thickness of the TiN layer would have been within purview of one of ordinary skill in the art at the time of the invention to achieve the desired results of the layer.

Applicant argues that "...the binder layer in applicant's claimed chalcopyrite type solar cell is not utilized solely for a binding function..." (pp 7 of Arguments).

The Examiner respectfully notes that the intended use of the binding layer is not a persuasive argument. The TiN layer provided by the prior art will serve the same function as the instantly claimed layer.

Applicant argues that "The cited references do not note the problem caused by the impurities contained in the mica aggregate substrate" (pp 7 of Arguments).

The Examiner notes that the references used in combination teach the two layer of TiN sandwiching the smoothing layer. The TiN layers will serve as a binder and a diffusion prevention layer as the materials in the instant claim and the materials taught by the prior art are the same. It is known in the art to utilize TiN as a diffusion prevention layer as well as a binder layer. Further the determination of the thickness of the layers would have been within purview of one of ordinary skill in the art at the time of the invention.

Applicant argues that "The Nakazawa reference does not explicitly suggest the use of TiN or TaN in the bonding layer" (pp 8 of Arguments).

The Examiner directs Applicant to the Office Action above for a full discussion of the references. Nakazawa is not relied upon to teach the use of TiN or TaN in the bonding layer. Takeshi is relied upon as a teaching of the use of TiN as binder layers.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact/Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shannon Gardner whose telephone number is (571)270-5270. The examiner can normally be reached on Monday to Thursday, 8am-5pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on 571.272.1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/S. G./
Examiner, Art Unit 1795

/Alexa D. Neckel/
Supervisory Patent Examiner, Art Unit 1795